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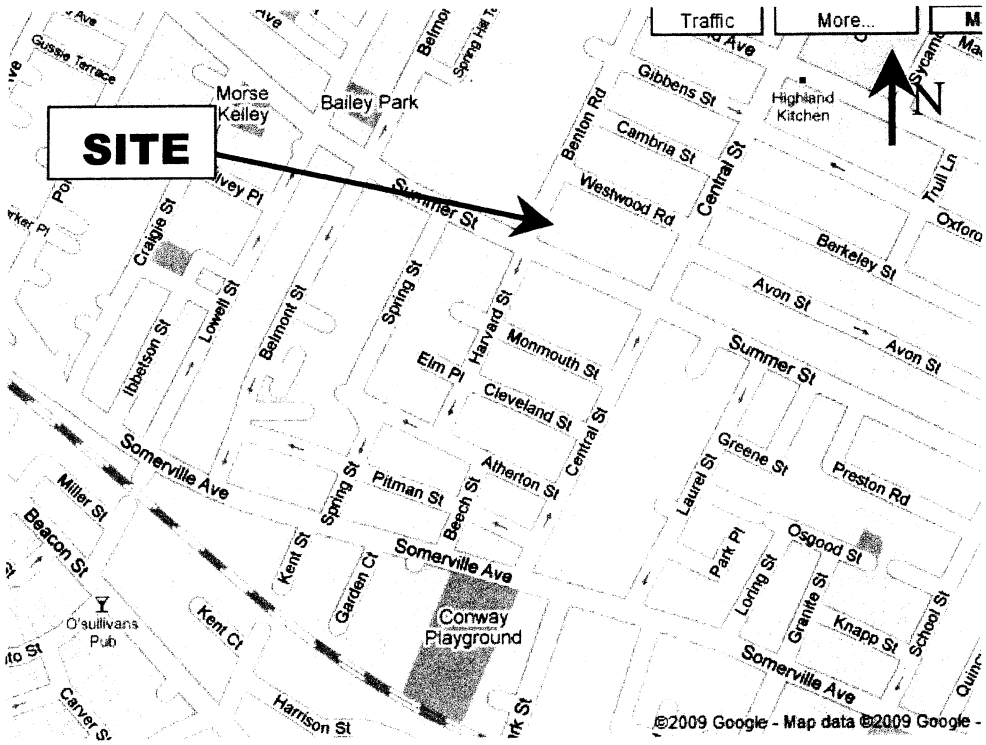
Drainage Report
For
3 Benton Road
Somerville, MA

May 2010



Prepared for:
Jose Martins
DCI Project #2009-021

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Project Narrative

Jose Martins is proposing to construct a tree family home at 3 Benton Road. The site is located on the east side of Benton Road immediately north of Summer Street.

The building lot was divided from a larger 21918 square foot lot, the new lot contains 9622 square feet.

There is currently an existing residence on the site. The USDA Natural Resource Conservation Service (NRCS) has mapped the soils on site as Newport/Urban, Sandy Loam, which has a hydrologic soil type classification of type C for the purpose of analysis. The Permeability of sandy loam is identified by The Mass DEP Stormwater Handbook (Rawls) as 1.02 inches per hour.

Proposed Site Development

The proposed building will contain three housing units, with five parking spaces. The first floor of the building will have approximately a 2400 square foot footprint and contain two garage spaces. The driveway will access from Benton Road, pass to the right side of the house and access the garage at the rear of the house. Public water and sewer disposal will be provided to the site via the public water mains in Benton Road. All other utilities will be provided to the project from service connections to the mains in Benton Road Street.

Stormwater Management

Currently, stormwater flows off the site towards abutting properties to the east with no visible controls. The proposed home will be provided with drywells to collect runoff from the roof, while runoff from the proposed driveway will be collected, directed through a deep sump catch basin for treatment and directed to the infiltration system as well. Overflow from the drainage system will flow to the Combined Sewer main in Summer Street. The proposed drywell ensures that there will not be an increase in runoff from the site after construction is complete.

LOCUS MAP

Name: BOSTON NORTH
Date: 5/3/110
Scale: 1 inch equals 1001 feet

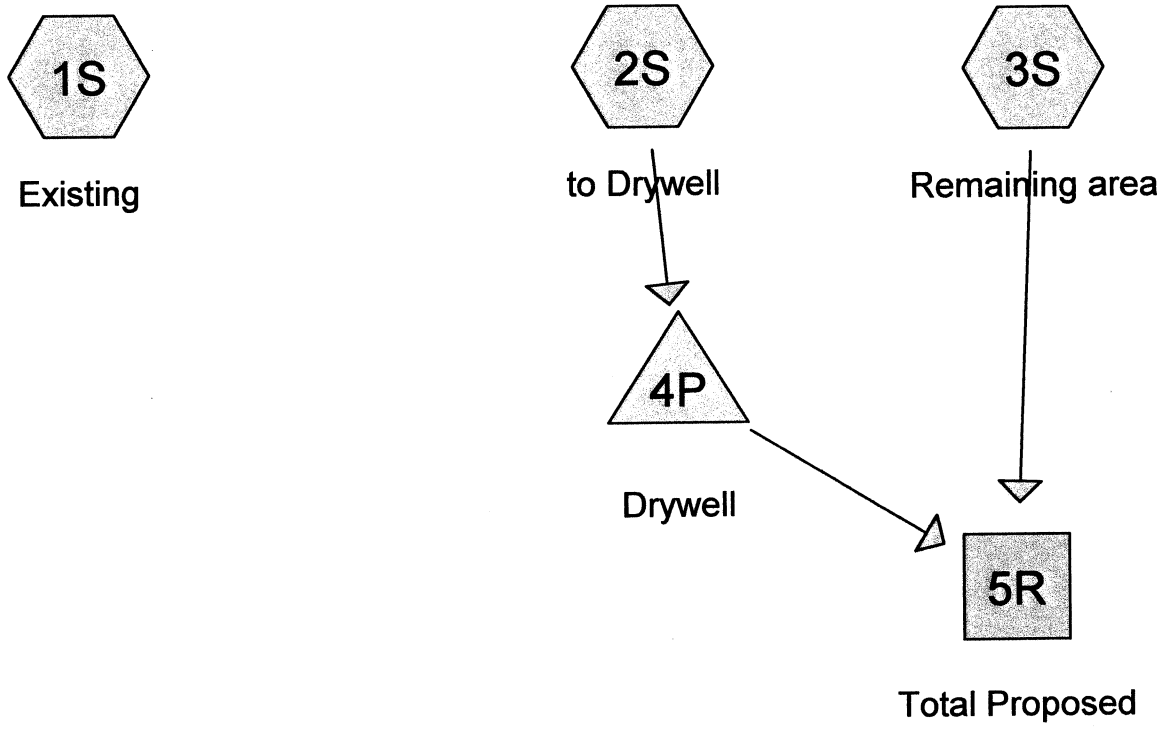
Location: 042° 23' 19.0" N 071° 06' 30.8" W

SUBSURFACE SOIL DATA

HYDROLOGIC SUMMARY
Of
3 BENTON ROAD
In
SOMERVILLE, MASSACHUSETTS

The analysis was performed for the 2, 10, 25, & 100-year storms; existing conditions were compared to proposed conditions to ensure that the proposed design will not substantially change the rate of runoff from the site. A summary of the results is as follows.

			2 year	10 year	25 year	100 year
Pre-Construction	Flow	(cfs)	0.97	1.83	2.22	2.78
Post-Construction	Flow	(cfs)	0.87	1.71	2.21	2.62



Subcat Reach Pond Link

Drainage Diagram for Benton Rd-Drain Design
Prepared by Design Consultants Inc., Printed 5/3/2010

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=24,050 sf 34.39% Impervious Runoff Depth=1.54"
Flow Length=145' Tc=6.1 min CN=82 Runoff=0.97 cfs 0.071 af

Subcatchment 2S: to Drywell Runoff Area=7,530 sf 77.03% Impervious Runoff Depth=2.35"
Flow Length=125' Tc=6.7 min CN=92 Runoff=0.45 cfs 0.034 af

Subcatchment 3S: Remaining area Runoff Area=15,580 sf 45.38% Impervious Runoff Depth=2.00"
Flow Length=66' Tc=4.1 min CN=88 Runoff=0.87 cfs 0.060 af

Reach 5R: Total Proposed Inflow=0.87 cfs 0.065 af
Outflow=0.87 cfs 0.065 af

Pond 4P: Drywell Peak Elev=88.82' Storage=643 cf Inflow=0.45 cfs 0.034 af
Discarded=0.02 cfs 0.028 af Primary=0.10 cfs 0.006 af Outflow=0.12 cfs 0.034 af

Total Runoff Area = 1.083 ac Runoff Volume = 0.164 af Average Runoff Depth = 1.82"
55.17% Pervious = 0.597 ac 44.83% Impervious = 0.485 ac

Summary for Subcatchment 1S: Existing

Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.071 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
8,270	98	Paved parking, HSG C
15,780	74	>75% Grass cover, Good, HSG C
24,050	82	Weighted Average
15,780		65.61% Pervious Area
8,270		34.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	95	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.1	145	Total			

Summary for Subcatchment 2S: to Drywell

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 0.034 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
5,800	98	Paved parking, HSG C
1,730	74	>75% Grass cover, Good, HSG C
7,530	92	Weighted Average
1,730		22.97% Pervious Area
5,800		77.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	20	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	55	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.7	125	Total			

Summary for Subcatchment 3S: Remaining area

Runoff = 0.87 cfs @ 12.06 hrs, Volume= 0.060 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
7,070	98	Paved parking, HSG C
8,510	79	50-75% Grass cover, Fair, HSG C
15,580	88	Weighted Average
8,510		54.62% Pervious Area
7,070		45.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	16	0.0900	4.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.1	66	Total			

Summary for Reach 5R: Total Proposed

Inflow Area = 0.531 ac, 55.69% Impervious, Inflow Depth = 1.47" for 2yr event
Inflow = 0.87 cfs @ 12.06 hrs, Volume= 0.065 af
Outflow = 0.87 cfs @ 12.06 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Drywell

Inflow Area = 0.173 ac, 77.03% Impervious, Inflow Depth = 2.35" for 2yr event
Inflow = 0.45 cfs @ 12.10 hrs, Volume= 0.034 af
Outflow = 0.12 cfs @ 12.47 hrs, Volume= 0.034 af, Atten= 73%, Lag= 22.4 min
Discarded = 0.02 cfs @ 12.47 hrs, Volume= 0.028 af
Primary = 0.10 cfs @ 12.47 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 88.82' @ 12.47 hrs Surf.Area= 557 sf Storage= 643 cf

Plug-Flow detention time= 279.5 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 280.6 min (1,079.0 - 798.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	87.00'	862 cf	**16.50'W x 33.00'L x 4.54'H Field A** 2,473 cf Overall - 318 cf Embedded = 2,155 cf x 40.0% Voids
#2A	87.50'	318 cf	**Cultec R-150** x 16 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap
#3	84.00'	94 cf	**4.00'D x 7.50'H Vertical Cone/Cylinder**
		1,274 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 83.00'
#2	Primary	88.60'	**6.0" Round Culvert** L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.60' / 87.60' S= 0.0060 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.02 cfs @ 12.47 hrs HW=88.82' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.10 cfs @ 12.47 hrs HW=88.82' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.10 cfs @ 1.77 fps)

Pond 4P: Drywell - Chamber Wizard Field A

Chamber Model = Cultec R-150
Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf
Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap

33.0" Wide + 6.0" Spacing = 39.0" C-C

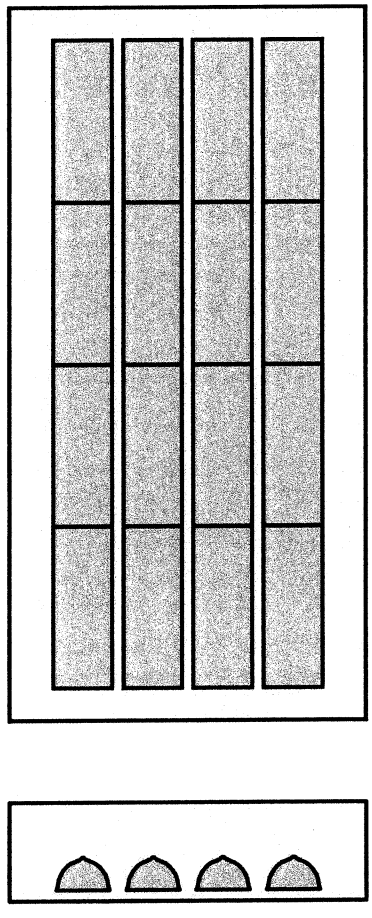
4 Chambers/Row x 7.50' Long = 30.00' + 18.0" End Stone x 2 = 33.00' Base Length
4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 24.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 18.5" Chamber Height + 30.0" Cover = 4.54' Field Height

16 Chambers x 19.9 cf = 317.9 cf Chamber Storage

2,472.9 cf Field - 317.9 cf Chambers = 2,155.1 cf Stone x 40.0% Voids = 862.0 cf Stone Storage

Stone + Chamber Storage = 1,179.9 cf = 0.027 af

16 Chambers
91.6 cy Field
79.8 cy Stone



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=24,050 sf 34.39% Impervious Runoff Depth=2.90"
Flow Length=145' Tc=6.1 min CN=82 Runoff=1.83 cfs 0.133 af

Subcatchment 2S: to Drywell Runoff Area=7,530 sf 77.03% Impervious Runoff Depth=3.89"
Flow Length=125' Tc=6.7 min CN=92 Runoff=0.72 cfs 0.056 af

Subcatchment 3S: Remaining area Runoff Area=15,580 sf 45.38% Impervious Runoff Depth=3.48"
Flow Length=66' Tc=4.1 min CN=88 Runoff=1.49 cfs 0.104 af

Reach 5R: Total Proposed Inflow=1.71 cfs 0.126 af
Outflow=1.71 cfs 0.126 af

Pond 4P: Drywell Peak Elev=89.29' Storage=755 cf Inflow=0.72 cfs 0.056 af
Discarded=0.02 cfs 0.033 af Primary=0.47 cfs 0.023 af Outflow=0.49 cfs 0.056 af

Total Runoff Area = 1.083 ac Runoff Volume = 0.293 af Average Runoff Depth = 3.25"
55.17% Pervious = 0.597 ac 44.83% Impervious = 0.485 ac

Summary for Subcatchment 1S: Existing

Runoff = 1.83 cfs @ 12.09 hrs, Volume= 0.133 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
8,270	98	Paved parking, HSG C
15,780	74	>75% Grass cover, Good, HSG C
24,050	82	Weighted Average
15,780		65.61% Pervious Area
8,270		34.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	95	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.1	145	Total			

Summary for Subcatchment 2S: to Drywell

Runoff = 0.72 cfs @ 12.10 hrs, Volume= 0.056 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
5,800	98	Paved parking, HSG C
1,730	74	>75% Grass cover, Good, HSG C
7,530	92	Weighted Average
1,730		22.97% Pervious Area
5,800		77.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	20	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	55	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.7	125	Total			

Summary for Subcatchment 3S: Remaining area

Runoff = 1.49 cfs @ 12.06 hrs, Volume= 0.104 af, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
7,070	98	Paved parking, HSG C
8,510	79	50-75% Grass cover, Fair, HSG C
15,580	88	Weighted Average
8,510		54.62% Pervious Area
7,070		45.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	16	0.0900	4.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.1	66	Total			

Summary for Reach 5R: Total Proposed

Inflow Area = 0.531 ac, 55.69% Impervious, Inflow Depth = 2.86" for 10-yr event
Inflow = 1.71 cfs @ 12.09 hrs, Volume= 0.126 af
Outflow = 1.71 cfs @ 12.09 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Drywell

Inflow Area = 0.173 ac, 77.03% Impervious, Inflow Depth = 3.89" for 10-yr event
Inflow = 0.72 cfs @ 12.10 hrs, Volume= 0.056 af
Outflow = 0.49 cfs @ 12.25 hrs, Volume= 0.056 af, Atten= 32%, Lag= 9.2 min
Discarded = 0.02 cfs @ 12.24 hrs, Volume= 0.033 af
Primary = 0.47 cfs @ 12.25 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 89.29' @ 12.20 hrs Surf.Area= 557 sf Storage= 755 cf

Plug-Flow detention time= 205.8 min calculated for 0.056 af (100% of inflow)
Center-of-Mass det. time= 207.4 min (992.1 - 784.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	87.00'	862 cf	**16.50'W x 33.00'L x 4.54'H Field A** 2,473 cf Overall - 318 cf Embedded = 2,155 cf x 40.0% Voids
#2A	87.50'	318 cf	**Cultec R-150** x 16 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap
#3	84.00'	94 cf	**4.00'D x 7.50'H Vertical Cone/Cylinder**
		1,274 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 83.00'
#2	Primary	88.60'	**6.0" Round Culvert** L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.60' / 87.60' S= 0.0060 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.02 cfs @ 12.24 hrs HW=89.24' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.47 cfs @ 12.25 hrs HW=89.24' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.47 cfs @ 2.43 fps)

Pond 4P: Drywell - Chamber Wizard Field A

Chamber Model = Cultec R-150
Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf
Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap

33.0" Wide + 6.0" Spacing = 39.0" C-C

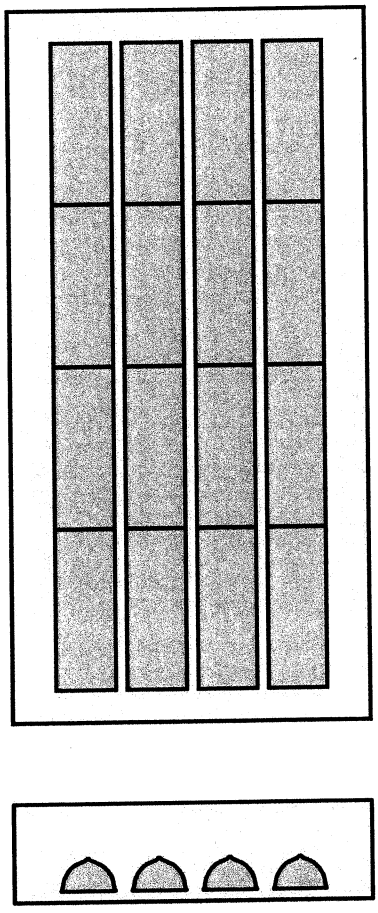
4 Chambers/Row x 7.50' Long = 30.00' + 18.0" End Stone x 2 = 33.00' Base Length
4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 24.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 18.5" Chamber Height + 30.0" Cover = 4.54' Field Height

16 Chambers x 19.9 cf = 317.9 cf Chamber Storage

2,472.9 cf Field - 317.9 cf Chambers = 2,155.1 cf Stone x 40.0% Voids = 862.0 cf Stone Storage

Stone + Chamber Storage = 1,179.9 cf = 0.027 af

16 Chambers
91.6 cy Field
79.8 cy Stone



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=24,050 sf 34.39% Impervious Runoff Depth=3.53"
Flow Length=145' Tc=6.1 min CN=82 Runoff=2.22 cfs 0.162 af

Subcatchment 2S: to Drywell Runoff Area=7,530 sf 77.03% Impervious Runoff Depth=4.58"
Flow Length=125' Tc=6.7 min CN=92 Runoff=0.84 cfs 0.066 af

Subcatchment 3S: Remaining area Runoff Area=15,580 sf 45.38% Impervious Runoff Depth=4.15"
Flow Length=66' Tc=4.1 min CN=88 Runoff=1.77 cfs 0.124 af

Reach 5R: Total Proposed Inflow=2.21 cfs 0.154 af
Outflow=2.21 cfs 0.154 af

Pond 4P: Drywell Peak Elev=89.65' Storage=838 cf Inflow=0.84 cfs 0.066 af
Discarded=0.02 cfs 0.035 af Primary=0.51 cfs 0.031 af Outflow=0.53 cfs 0.066 af

Total Runoff Area = 1.083 ac Runoff Volume = 0.352 af Average Runoff Depth = 3.90"
55.17% Pervious = 0.597 ac 44.83% Impervious = 0.485 ac

Summary for Subcatchment 1S: Existing

Runoff = 2.22 cfs @ 12.09 hrs, Volume= 0.162 af, Depth= 3.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.50"

Area (sf)	CN	Description
8,270	98	Paved parking, HSG C
15,780	74	>75% Grass cover, Good, HSG C
24,050	82	Weighted Average
15,780		65.61% Pervious Area
8,270		34.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	95	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.1	145	Total			

Summary for Subcatchment 2S: to Drywell

Runoff = 0.84 cfs @ 12.10 hrs, Volume= 0.066 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.50"

Area (sf)	CN	Description
5,800	98	Paved parking, HSG C
1,730	74	>75% Grass cover, Good, HSG C
7,530	92	Weighted Average
1,730		22.97% Pervious Area
5,800		77.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	20	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	55	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.7	125	Total			

Summary for Subcatchment 3S: Remaining area

Runoff = 1.77 cfs @ 12.06 hrs, Volume= 0.124 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=5.50"

Area (sf)	CN	Description
7,070	98	Paved parking, HSG C
8,510	79	50-75% Grass cover, Fair, HSG C
15,580	88	Weighted Average
8,510		54.62% Pervious Area
7,070		45.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	16	0.0900	4.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.1	66	Total			

Summary for Reach 5R: Total Proposed

Inflow Area = 0.531 ac, 55.69% Impervious, Inflow Depth = 3.49" for 25yr event
Inflow = 2.21 cfs @ 12.07 hrs, Volume= 0.154 af
Outflow = 2.21 cfs @ 12.07 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Drywell

Inflow Area = 0.173 ac, 77.03% Impervious, Inflow Depth = 4.58" for 25yr event
Inflow = 0.84 cfs @ 12.10 hrs, Volume= 0.066 af
Outflow = 0.53 cfs @ 12.21 hrs, Volume= 0.066 af, Atten= 37%, Lag= 6.6 min
Discarded = 0.02 cfs @ 12.21 hrs, Volume= 0.035 af
Primary = 0.51 cfs @ 12.21 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 89.65' @ 12.21 hrs Surf.Area= 557 sf Storage= 838 cf

Plug-Flow detention time= 187.9 min calculated for 0.066 af (100% of inflow)
Center-of-Mass det. time= 189.4 min (969.9 - 780.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	87.00'	862 cf	**16.50'W x 33.00'L x 4.54'H Field A** 2,473 cf Overall - 318 cf Embedded = 2,155 cf x 40.0% Voids
#2A	87.50'	318 cf	**Cultec R-150** x 16 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap
#3	84.00'	94 cf	**4.00'D x 7.50'H Vertical Cone/Cylinder**
		1,274 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 83.00'
#2	Primary	88.60'	**6.0" Round Culvert** L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.60' / 87.60' S= 0.0060 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.02 cfs @ 12.21 hrs HW=89.64' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.51 cfs @ 12.21 hrs HW=89.64' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.51 cfs @ 2.59 fps)

Pond 4P: Drywell - Chamber Wizard Field A

Chamber Model = Cultec R-150
Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf
Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap

33.0" Wide + 6.0" Spacing = 39.0" C-C

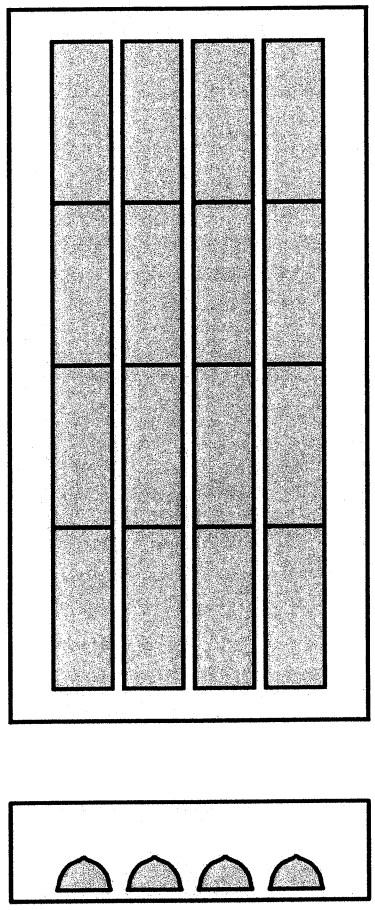
4 Chambers/Row x 7.50' Long = 30.00' + 18.0" End Stone x 2 = 33.00' Base Length
4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 24.0" Side Stone x 2 = 16.50' Base Width
6.0" Base + 18.5" Chamber Height + 30.0" Cover = 4.54' Field Height

16 Chambers x 19.9 cf = 317.9 cf Chamber Storage

2,472.9 cf Field - 317.9 cf Chambers = 2,155.1 cf Stone x 40.0% Voids = 862.0 cf Stone Storage

Stone + Chamber Storage = 1,179.9 cf = 0.027 af

16 Chambers
91.6 cy Field
79.8 cy Stone



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=24,050 sf 34.39% Impervious Runoff Depth=4.45"
Flow Length=145' Tc=6.1 min CN=82 Runoff=2.78 cfs 0.205 af

Subcatchment 2S: to Drywell Runoff Area=7,530 sf 77.03% Impervious Runoff Depth=5.56"
Flow Length=125' Tc=6.7 min CN=92 Runoff=1.01 cfs 0.080 af

Subcatchment 3S: Remaining area Runoff Area=15,580 sf 45.38% Impervious Runoff Depth=5.11"
Flow Length=66' Tc=4.1 min CN=88 Runoff=2.15 cfs 0.152 af

Reach 5R: Total Proposed Inflow=2.62 cfs 0.195 af
Outflow=2.62 cfs 0.195 af

Pond 4P: Drywell Peak Elev=90.10' Storage=943 cf Inflow=1.01 cfs 0.080 af
Discarded=0.02 cfs 0.038 af Primary=0.58 cfs 0.042 af Outflow=0.60 cfs 0.080 af

Total Runoff Area = 1.083 ac Runoff Volume = 0.437 af Average Runoff Depth = 4.84"
55.17% Pervious = 0.597 ac 44.83% Impervious = 0.485 ac

Summary for Subcatchment 1S: Existing

Runoff = 2.78 cfs @ 12.09 hrs, Volume= 0.205 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=6.50"

Area (sf)	CN	Description
8,270	98	Paved parking, HSG C
15,780	74	>75% Grass cover, Good, HSG C
24,050	82	Weighted Average
15,780		65.61% Pervious Area
8,270		34.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	95	0.0480	3.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.1	145	Total			

Summary for Subcatchment 2S: to Drywell

Runoff = 1.01 cfs @ 12.10 hrs, Volume= 0.080 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=6.50"

Area (sf)	CN	Description
5,800	98	Paved parking, HSG C
1,730	74	>75% Grass cover, Good, HSG C
7,530	92	Weighted Average
1,730		22.97% Pervious Area
5,800		77.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	20	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	55	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.7	125	Total			

Summary for Subcatchment 3S: Remaining area

Runoff = 2.15 cfs @ 12.06 hrs, Volume= 0.152 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=6.50"

Area (sf)	CN	Description
7,070	98	Paved parking, HSG C
8,510	79	50-75% Grass cover, Fair, HSG C
15,580	88	Weighted Average
8,510		54.62% Pervious Area
7,070		45.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.1	16	0.0900	4.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.1	66	Total			

Summary for Reach 5R: Total Proposed

Inflow Area = 0.531 ac, 55.69% Impervious, Inflow Depth = 4.40" for 100yr event
Inflow = 2.62 cfs @ 12.06 hrs, Volume= 0.195 af
Outflow = 2.62 cfs @ 12.06 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Drywell

Inflow Area = 0.173 ac, 77.03% Impervious, Inflow Depth = 5.56" for 100yr event
Inflow = 1.01 cfs @ 12.10 hrs, Volume= 0.080 af
Outflow = 0.60 cfs @ 12.22 hrs, Volume= 0.080 af, Atten= 40%, Lag= 7.2 min
Discarded = 0.02 cfs @ 12.22 hrs, Volume= 0.038 af
Primary = 0.58 cfs @ 12.22 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 90.10' @ 12.22 hrs Surf.Area= 557 sf Storage= 943 cf

Plug-Flow detention time= 170.6 min calculated for 0.080 af (100% of inflow)
Center-of-Mass det. time= 170.2 min (945.7 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	87.00'	862 cf	**16.50'W x 33.00'L x 4.54'H Field A** 2,473 cf Overall - 318 cf Embedded = 2,155 cf x 40.0% Voids
#2A	87.50'	318 cf	**Cultec R-150** x 16 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 7.50'L = 19.9 cf Overall Size= 33.0"W x 18.5"H x 8.50'L with 1.00' Overlap
#3	84.00'	94 cf	**4.00'D x 7.50'H Vertical Cone/Cylinder**
		1,274 cf	Total Available Storage

Storage Group A created with Chamber Wizard

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Discarded OutFlow Max=0.02 cfs @ 12.22 hrs HW=90.09' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.58 cfs @ 12.22 hrs HW=90.09' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.58 cfs @ 2.94 fps)

Pond 4P: Drywell - Chamber Wizard Field A

Chamber Model = Cultec R-150
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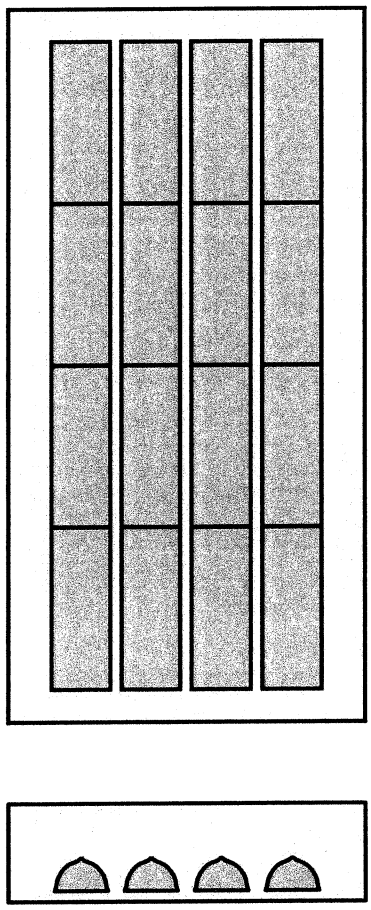

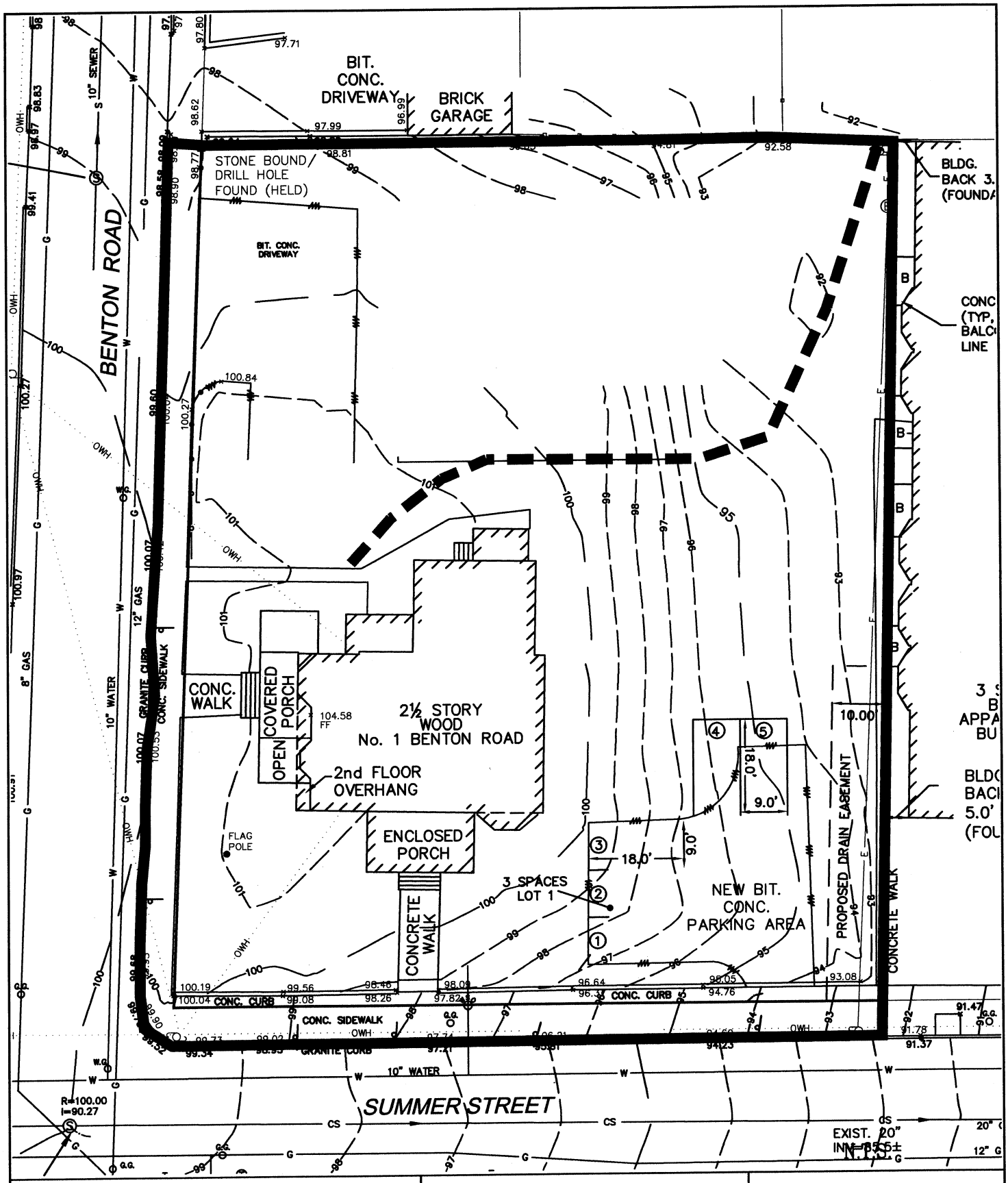

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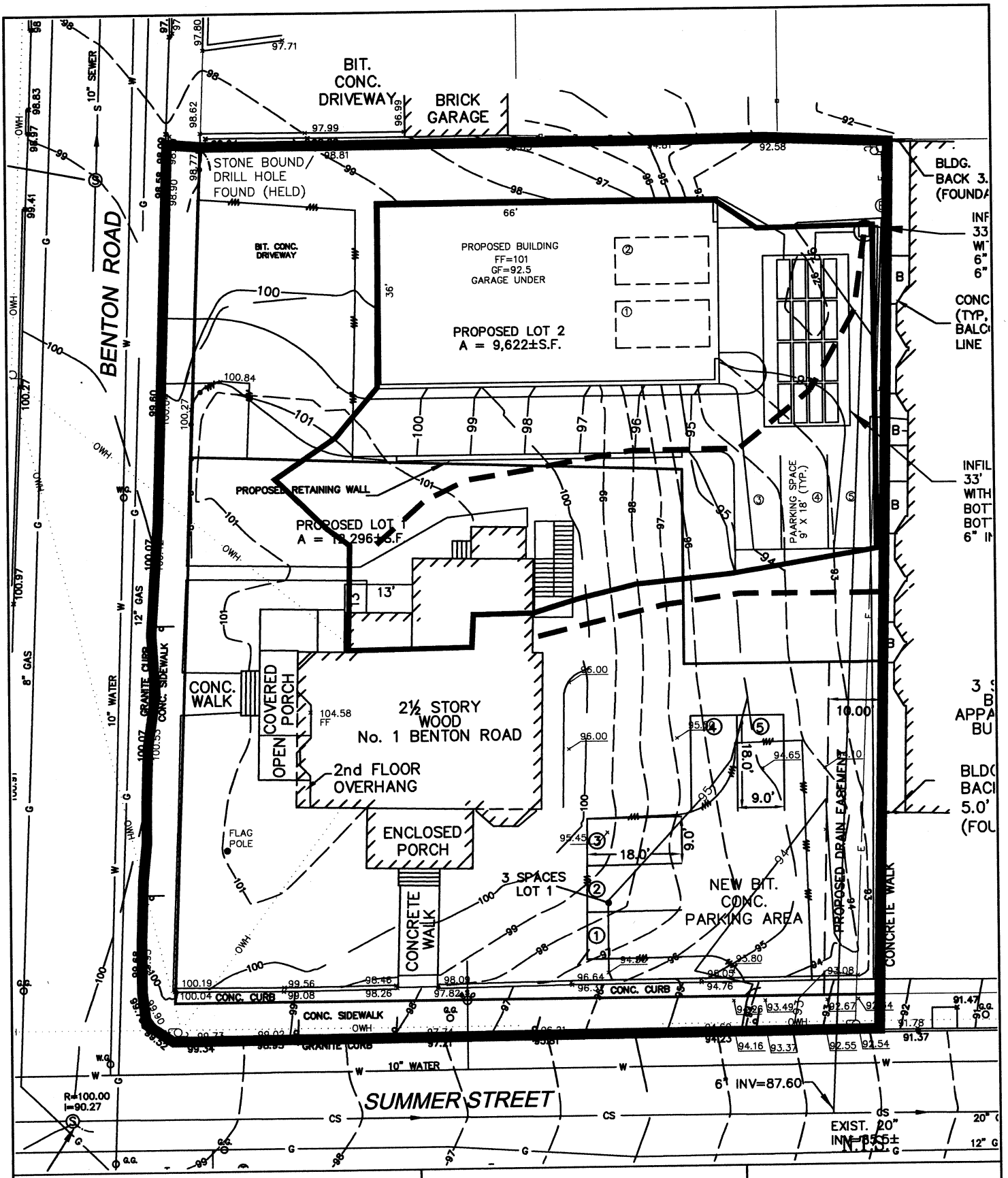
EXISTING DRAINA AREA MAP

FIGURE 1



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PROPOSED DRAINA AREA MAP

FIGURE 2